BULLETIN OF STOMATOLOGY AND MAXILLOFACIAL SURGERY
Volume 21, Issue 4

DOI: 10.58240/1829006X-2025.21.4-377

ORIGINAL RESEARCH

ASSESSMENT OF RELATIONSHIP BETWEEN MAXILLARY TEETH AND MAXILLARY SINUS

Nisha Jaisree S[1], Reshma Poothakulath Krishnan[2] Deepak Pandiar[3]

[1]Department of Oral Pathology and Microbiology Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai India, nish.snj19@gmail.com ORCID ID: https://orcid.org/0000-0003-3306-8514

[2]Department of Oral Pathology and Microbiology Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, India

[3]Department of Oral Pathology and Microbiology Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, India,

Corresponding author: Reshma Poothakulath Krishnan Department of Oral Pathology and Microbiology Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, India, e-mail reshmakpai@gmail.com

Received: *May 5, 2025;* ***Accepted:*** *May. 30, 2025;* ***Published:*** *Jun. 10,2025*

ABSTRACT

Background:The maxillary sinus is the largest paranasal sinus which has a close anatomical relationship with the roots of maxillary posterior teeth, which results in clinical challenges during dental procedures including extractions, implant procedures and endodontic treatments. Odontogenic infections and surgical interventions can lead to disruption in the sinus floor, leading to oroantral communication or sinusitis. The present study aims to evaluate the proximity of maxillary posterior tooth roots to the maxillary sinus floor using orthopantomograms (OPGs).

Methodology;A retrospective, observational study analyzing 351 OPGs of patients aged 25–30 years, were selected. The relationship between roots of maxillary posterior teeth and maxillary sinus was assessed using a modified scoring system by Sharan and Madjar (2006), which classified root projection into the maxillary sinus with a score from 0 (no contact) to 4 (>2 mm intrusion). The data were tabulated in excel sheets and statistical analysis was done using SPSS software, chi-square tests were done. A p-value of <0.05 was considered statistically significant.

Results:The present study revealed considerable variations in root-sinus proximity among different maxillary posterior teeth. The highest root projection into the sinus cavity was observed in first and second molars. Tooth 27 exhibited the most frequent intrusion into the sinus, with 47.2% scoring 3 and 22.5% scoring 4. Gender-based analysis indicated that males had a significantly higher frequency of root projection into the sinus, particularly for tooth 16 (χ^2 = 17.584, p = 0.001). Chi-square analysis demonstrated significant bilateral symmetry in root-sinus relationships, with the strongest association found between the right and left first premolars (χ^2 = 136.47, p < 0.001).

Conclusion;The study confirms the anatomical variations in the relationship between maxillary posterior teeth and the maxillary sinus floor, with molars demonstrating the closest proximity. The findings emphasize the need for thorough preoperative radiographic evaluation, particularly for procedures involving maxillary posterior teeth, to minimize complications such as sinus perforation and infections. Gender differences in sinus pneumatization and root projection suggest potential implications for personalized treatment planning.

Keywords: OPG, Maxillary sinus, Maxillary posterior teeth

INTRODUCTION

Maxillary sinus is the largest of all the paranasal sinuses, it is located bilaterally within the maxilla, and plays an important role in various physiological processes including humidification and air filtration [2]. Owing to the close anatomical proximity between the roots of the maxillary posterior teeth and the floor of the maxillary sinus, there exist significant clinical and diagnostic challenges for the clinicians while treating maxillary posterior teeth [3].

Pathological conditions which originate from the maxillary posterior teeth, such as periapical pathologies or periodontal infections, may traverse the boundaries of supporting dental structures and affect the maxillary sinus. This phenomenon is termed as odontogenic maxillary sinusitis, it is a condition which arises from dental infections (commonly dental caries) and can result in complications such as obstruction of the sinus and oroantral communication [4]. Dental procedures such as endodontic therapy or dental extractions can compromise the integrity of the sinus floor and result in conditions such as perforation of the sinus or root displacement into the sinus cavity, which may require surgical intervention [5].

The anatomy of the sinus floor is very unique, as it extends between the individual roots of adjacent teeth to form elevations which are referred to as “blocks” on the sinus antral surface [1]. Understanding the relationship between the roots of maxillary posterior teeth and maxillary sinus is essential for a dental practitioner, as it aids in treatment planning of various procedures such as implant placement, sinus augmentation, and the management of sinus-related dental pathologies and complications [6]. Various radiographic imaging modalities provide ardent information on the anatomical relationship to aid clinicians in assessing the variations in proximity to the sinus floor in order to evaluate the potential risks with the interventions. Orthopantomogram (OPG) is a valuable 2-dimensional tool which helps in visualising numerous anatomical structures of the jaws [7].

The present study aims to evaluate the relationship between the apical roots of maxillary posterior teeth and the floor of the maxillary sinus, by assessing numerous OPGs.

MATERIAL AND METHOD

Study Design

The study design is a retrospective, observational study conducted to assess the relationship between the apical roots of maxillary posterior teeth and the floor of the maxillary sinus using orthopantomograms (OPGs). Ethical clearance was obtained from the institutional ethical review board to ensure compliance with ethical standards.

Sample Selection

A total of 500 OPGs of patients who belong to the age group between 25 to 30 years visiting the Oral radiology department for diagnostic purposes were collected. Inclusion criteria was patients with intact maxillary posterior teeth with not more than two missing teeth. Patients with any form of periapical pathology involving maxillary posterior teeth, previous sinus surgeries, or dental extractions were excluded from the study. Following the above mentioned criteria, 351 OPGs were chosen eligible for further analysis.

Data Collection

The OPGs were evaluated using a modified scale with a scoring criteria proposed by Sharan and Madjar [1]. This scale categorizes the relationship between the roots of maxillary posterior teeth and the maxillary sinus floor into 5 categories ranging from 0 to 4. The radiographic assessments were conducted independently by two calibrated examiners to ensure accuracy and reliability.

Scale (scoring criteria) [8]

The scoring criteria for assessing root and sinus relationship includes a score of 0, which indicates no contact between any root of the posterior teeth and the cortical border of the floor of the sinus. Score 1 signifies that one or more posterior teeth roots are in contact with the cortical borders of the sinus. A Score of 2 indicates that one or more posterior tooth roots project laterally onto the sinus cavity, but their apices remain outside the sinus boundaries. A score of 3 indicates that one or more root apices project into the sinus cavity but less than 2 mm. Lastly, score 4 indicates that one or more root apices project into the sinus cavity by a distance greater than 2 mm.

Statistical Analysis

The data obtained were tabulated in Microsoft Excel and statistical analysis was done using SPSS software version 23. Descriptive statistics and Chi-square tests were performed to summarize and assess the significance of the relationship between each of the maxillary posterior teeth roots and the sinus floor. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Patient confidentiality was maintained by anonymizing all radiographs and records. Only the necessary data were extracted, and the study adhered to the ethical principles outlined in the Declaration of Helsinki.

RESULTS

Overview of Scoring System

The results of the study highlight the significant variability in the relationship between the roots of maxillary posterior teeth and the floor of the maxillary sinus (Table 1).

Table 1. Showing total number of teeth with respective scores

SCORE / TOOTH	0	1	2	3	4
18	69	160	11	78	33
17	18	113	13	136	71
16	11	110	15	119	96
15	34	193	20	87	17
14	148	187	4	8	4
24	180	160	4	4	3
25	59	245	19	21	7
26	22	97	25	153	54
27	13	75	18	166	79
28	40	149	8	108	46

Using a scoring system ranging from 0 to 4, the findings reveal distinct patterns of root-sinus proximity. A score of 0 indicated no contact between the root and the sinus, while scores of 3 and 4 represented roots projecting into the sinus cavity, with 4 indicating deeper penetration (>2 mm). The study focused on teeth 17, 16, 15, 14, 24, 25, 26, and 27, which are the maxillary first and second molars on both sides.

Findings for Tooth 17 and Tooth 16

For tooth 17, 38% of cases were assigned a score of 3, demonstrating root projection into the sinus cavity with less than 2 mm of separation. Additionally, 20.2% scored 4, indicating roots projecting more than 2 mm into the sinus. Similarly, for tooth 16, 27.3% of cases had a score of 3, while 33.9% exhibited a score of 4.

Findings for Tooth 26 and Tooth 27

For the left side, tooth 26 showed 43.5% of cases with a score of 3, and 15.3% with a score of 4. Tooth 27 had the highest percentage of roots projecting into the sinus cavity, with 47.2% scoring 3 and 22.5% scoring 4.

Findings for Tooth 14 and Tooth 15

Tooth 14 demonstrated the following distribution of scores: 148 cases (42.2%) scored 0, indicating no contact between the root and the maxillary sinus. A total of 187 cases (53.3%) scored 1, showing root-sinus proximity without penetration into the sinus cavity. Scores of 2, 3, and 4 were observed in 4 cases (1.1%), 8 cases (2.3%), and 4 cases (1.1%), respectively. For tooth 15, 193 cases (55.0%) scored 1, indicating root-sinus proximity without penetration. A total of 34 cases (9.7%) scored 0, showing no contact with the sinus floor. Scores of 2, 3, and 4 were observed in 20 cases (5.7%), 87 cases (24.8%), and 17 cases (4.8%), respectively

Findings for Tooth 24 and Tooth 25

Tooth 24 exhibited a distribution of scores as follows: 180 cases (51.3%) scored 0, indicating no contact with the sinus floor. A total of 160 cases (45.6%) scored 1, showing root-sinus proximity without penetration. Scores of 2, 3, and 4 were observed in 4 cases (1.1%), 4 cases (1.1%), and 3 cases (0.9%), respectively. For tooth 25, 245 cases (69.8%) scored 1, indicating root-sinus proximity without penetration, while 59 cases (16.8%) scored 0, showing no contact with the sinus floor. Scores of 2, 3, and 4 were observed in 19 cases (5.4%), 21 cases (6.0%), and 7 cases (2.0%), respectively.

Chi square test:

The chi-square test revealed significant associations between the corresponding right and left molars and premolars (Table 2). For the third molars (18 and 28), the Pearson chi-square value was 36.327 (df = 16, p = 0.003), indicating a statistically significant relationship between their anatomical or positional attributes. Similarly, the second molars (17 and 27) showed a strong association, with a chi-square value of 98.707 (df = 16, p < 0.001), suggesting a consistent bilateral relationship in their characteristics. The first molars (16 and 26) exhibited an even stronger association, with a chi-square value of 113.685 (df = 16, p < 0.001), underscoring their bilateral symmetry or shared morphological patterns (Figure 1).

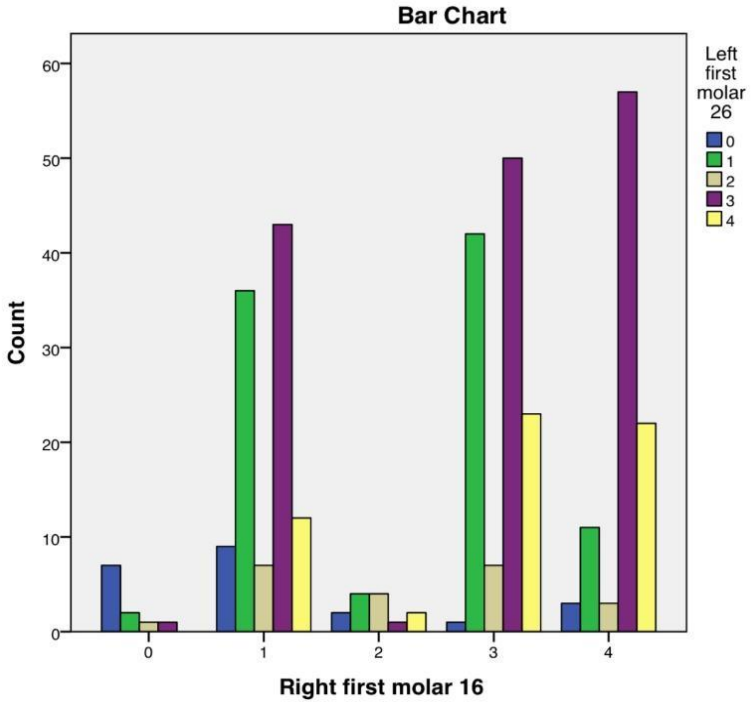

Figure 1. Graphical representation of the correlation of the relationship of maxillary sinus to right and left first maxillary molar

The second premolars (15 and 25) also demonstrated a highly significant relationship, with a chi-square value of 116.444 (df = 16, p < 0.001). Lastly, the first premolars (14 and 24) displayed the strongest bilateral association among the tested groups, with a chi-square value of 136.470 (df = 16, p < 0.001).

The second premolars (15 and 25) also demonstrated a highly significant relationship, with a chi-square value of 116.444 (df = 16, p < 0.001). Lastly, the first premolars (14 and 24) displayed the strongest bilateral association among the tested groups, with a chi-square value of 136.470 (df = 16, p < 0.001).

Gender-Based Analysis

The gender-based analysis indicated variations in root-sinus proximity for certain teeth, particularly tooth 16 (Table 3).

Table 2. showing Chi square test results between right and left posterior teeth

Teeth Pair	Chi-Square Value	p-Value
Right Third Molar (18) - Left Third Molar (28)	36.327	0.003
Right Second Molar (17) - Left Second Molar (27)	98.707	<0.001
Right First Molar (16) - Left First Molar (26)	113.685	<0.001
Right Second Premolar (15) - Left Second Premolar (25)	116.444	<0.001
Right First Premolar (14) - Left First Premolar (24)	136.47	<0.001

Table 3 showing Chi square test results for gender based analysis

Teeth	Chi-Square Value	p-Value
Right Third Molar (18)	4.908	0.297
Right Second Molar (17)	2.714	0.607
Right First Molar (16)	17.584	0.001
Right Second Premolar (15)	0.606	0.962
Right First Premolar (14)	6.052	0.195
Left First Premolar (24)	11.916	0.018
Left Second Premolar (25)	10.962	0.027
Left First Molar (26)	0.611	0.962
Left Second Molar (27)	3.794	0.435
Left Third Molar (28)	3.934	0.415

Male patients accounted for a higher percentage of cases with scores 3 and 4 compared to females. Chi square tests for association between gender and the positional or anatomical characteristics of molars and premolars showed the following results. Right third molar (18), the chi-square test revealed no significant association with gender ($\chi^2 = 4.908$, df = 4, p = 0.297). Similarly, the right second molar (17) ($\chi^2 = 2.714$, df = 4, p = 0.607) and the right second premolar (15) ($\chi^2 = 0.606$, df = 4, p = 0.962) showed no significant gender-based differences. However, a significant association was observed for the right first molar (16) ($\chi^2 = 17.584$, df = 4, p = 0.001), suggesting potential gender-related differences in its positional attributes (Figure 2).

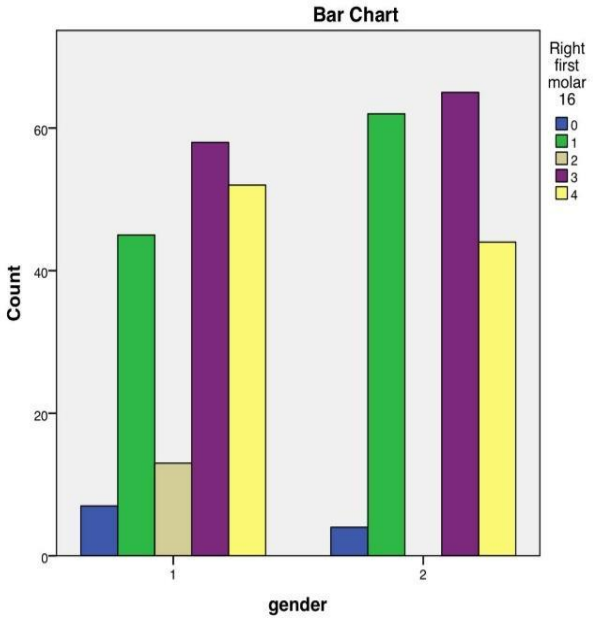

Figure 2. Graphical representation of the correlation of gender and the relation of maxillary sinus to right first maxillary molar

On the left side, the first premolar (24) ($\chi^2 = 11.916$, df = 4, p = 0.018) and second premolar (25) ($\chi^2 = 10.962$, df = 4, p = 0.027) also showed significant associations with gender, while other teeth, including the left first molar (26) (Figure 3), left second molar (27), and left third molar (28), did not exhibit any significant gender-based differences (p > 0.05).

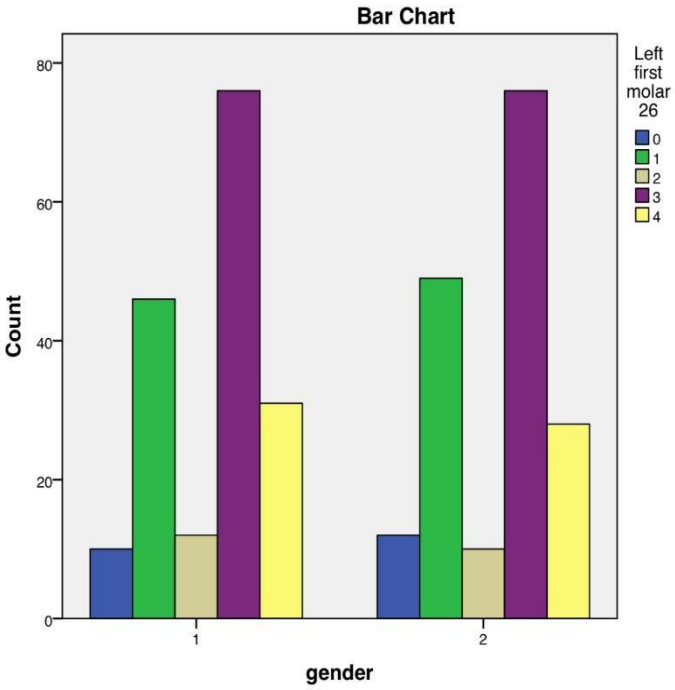

Figure 3: Graphical representation of the correlation of gender and the relation of maxillary sinus to left first maxillary molar

DISCUSSION

The anatomical relationship between the maxillary sinus and the roots of posterior maxillary teeth plays a critical role in numerous dental and surgical procedures. The present study evaluated the relationship between maxillary tooth roots and their proximity to the sinus floor.

Variations in the anatomy of the maxillary sinus are influenced by several factors such as gender, age, and oral health [9]. In the present study, gender based variations in proximity of the posterior teeth roots to the floor of the sinus are noted, especially in tooth 16, which exhibited significant proximity to the sinus compared to other teeth. This could be due to differences in craniofacial morphology among males and females, wherein males usually demonstrate larger maxillary sinuses with thicker alveolar bones compared to females, with increased pneumatization of sinus leading to thinner alveolar bone which separates the roots and the sinus floor [10].

Variations in sinus root proximity have been observed among various populations which highlight the influence of ethnicity and geographical factors [11]. Also genetic predisposition, dietary habits greatly influence jaw development and play an ardent role in such differences [12]. The findings observed in the present study reveal that gender based craniofacial patterns, sinus dimensions and density of alveolar bone contribute to the varied anatomic relationships observed in root proximity to the sinus.

Literature states that sinus pneumatization is an age-related phenomenon which influences root proximity. It has been observed that the pneumatization process continues till the second decade in females and third decade in males [13]. The early skeletal maturation in females compared to males contributes to gender based variations in root proximity, as observed in the present study.

Among the first and second premolars, 14, 15, 24 & 25, and the anterior teeth, minimal sinus involvement is reported [14]. These findings are concordant with the present study as predominantly lower scores were observed among the premolars depicting minimal interaction. The reason could be due to short roots and more anterior positioning of such teeth. Also, there is a presence of denser bone in the anterior maxilla which serves as a structural barrier between the roots and sinus [15].

Sharan et al. observed that the roots of the maxillary first and second molar are in close proximity to the sinus floor often with their roots projecting into the sinus cavity [8]. These findings are concordant with the findings observed in the present study. The reason for close proximity in molars could be due to age-driven pneumatization of the posterior maxilla which can be further exacerbated by tooth loss. The development of mesiobuccal and palatal roots of molars coincides along with sinus expansion, which ultimately results in reduced bony separation between these roots and sinus [16].

A study by SH et al. revealed that the mesiobuccal root of the maxillary first molar often lies in closest proximity to the sinus floor, emphasising the need for precise imaging prior to treatment planning [17]. These findings are similar to the findings observed in the current study. The reason for close proximity among the mesiobuccal root of the first molar to the sinus floor could be due to its developmental positioning which increases the risk of direct sinus contact [18].

Studies conducted using 3-dimensional modalities such as CBCT reveal that first molars are in direct contact with their root apices projecting into the sinus cavity [19]. These findings support the results observed in the present study. Since maxillary molars are associated with narrow alveolar bone width, in areas of significant pneumatization, along with a widely spread root morphology, increasing its likelihood of interaction with the sinus cavity [20].

The buccodistal root of the second molars has been reported to have close proximity to the sinus in a few studies [21], which aligns with the findings of the present study. The buccodistal root of the second molars are located in regions with the thinnest alveolar bone density and also owing to the curvature of the maxillary arch, this region is exposed to increased mechanical stresses and bone resorption, thereby reducing its thickness further [16]. The findings for teeth 17 and 26 in this study reinforce the need for detailed imaging and surgical planning.

Studies indicate that the thickness of Schneiderian membrane varies depending on the underlying pathology. Teeth with higher proximity scores such as 3 and 4 as seen in first and second molars, are often associated with greater risks of sinus perforation during surgical interventions [20]. The findings for teeth 17 and 26 in this study reinforce the need for detailed imaging and surgical planning. In instances such as chronic inflammation and anatomical variations, thinning of the Schniedarian membrane can occur. When the apices of posterior teeth roots are in close proximity, it further weakens the membrane and increases the chances of perforation during surgery [22].

Studies on sinonasal complications of dental disease and treatment (SCDDT) underscore the significant role of dental pathology in sinusitis. The anatomical proximity of maxillary posterior tooth roots to the sinus floor can contribute to either unilateral or bilateral sinus inflammation. These findings highlight the necessity of precise diagnostic imaging, such as CT scans, and a multidisciplinary approach for effective management [23].

Studies on sinus septa reveal the anatomical variations in the maxillary sinus and its proximity to the posterior teeth. The first and second molar regions demonstrated highest prevalence of septa, which can lead to complications in sinus lift procedures, thus reinforcing the importance of detailed evaluation of sinus-tooth proximity to minimize surgical risks [24].

Studies have shown that there exist variations in sinus depths with shallow regions located between the right maxillary molar and deeper regions between the left maxillary premolars [25]. These findings are in concordance with the present study where the majority of the premolar teeth exhibited low proximity scores (0 or 1), indicating a more distant anatomical relationship with the sinus floor. Age and gender also played a role, with older individuals showing greater root-sinus separation and males exhibiting thicker buccal bone than females [26, 27]. Similar trends were observed in the present study.

Clinical Implications

This study underscores the importance of comprehensive radiographic assessments, particularly for posterior teeth, where scores of 3 or 4 indicate a high risk of complications such as sinus perforation or oroantral communication. Teeth 16, 17, 26, and 27, which demonstrated significant proximity to the sinus floor, require meticulous planning for procedures such as extractions, implants, or endodontic therapy.

While anterior teeth, such as 24 and 25, exhibit minimal sinus interaction, anatomical variability necessitates thorough evaluations even for these teeth to minimize potential risks.

Future Directions

Future research should investigate factors such as age-related changes, population-based anatomical variations, and sinus septa morphology to provide a more comprehensive understanding of the root-sinus relationship. Incorporating advanced imaging modalities, such as CBCT, into routine evaluations will enhance diagnostic accuracy and improve treatment outcomes.

CONCLUSION

The findings of this study align with existing literature, emphasizing the importance of understanding anatomical variations and using detailed imaging for safe and effective dental procedures. Further research into ethnicity and age-related anatomical changes could offer additional insights into the relationship between maxillary teeth and the sinus floor.

DECLARATIONS

Funding
The work was not funded.

Ethical Approval
"Not applicable"

Consent for publication
"Not applicable"

Ethical approval
None

Competing interest
The authors declare that there are no competing interest.

Acknowledgements
None

REFERENCES

1. Krouse JH. The unified airway. Facial Plast Surg Clin North Am. 2012;20(1):55-60.

2. Swathi KV, Maragathavalli G. Assessment of the vertical relationship between the maxillary posterior teeth and the maxillary antral floor in a South Indian population using cone beam computed tomography – A radiographic observational study. Biomedicine (India). 2022;42(3):499–503. doi:10.51248/.v42i3.1411

3.

4. Shokri A, Lari S, Yousefi F, Hashemi L. Assessment of the relationship between the maxillary sinus floor and maxillary posterior teeth roots using cone beam computed tomography. J Contemp Dent Pract. 2014;15(5):618-22.
5. Psillas G, Papaioannou D, Petsali S, Dimas GG, Constantinidis J. Odontogenic maxillary sinusitis: a comprehensive review. J Dent Sci. 2021 Jan;16(1):474-81.
6. Martu C, Martu MA, Maftei GA, Diaconu-Popa DA, Radulescu L. Odontogenic sinusitis: from diagnosis to treatment possibilities—a narrative review of recent data. Diagnostics (Basel). 2022 Jun 30;12(7):1600.
7. Gocmen G, Bayram F, Ates O. The importance of maxillary sinuses in oral and maxillofacial surgical procedures. In: Paranasal Sinuses - Surgical Anatomy and Its Applications. IntechOpen; 2024.
8. Sridhar M, Mathew MG, Meenakshi. Panoramic radiographs and its importance in pediatric dentistry – A retrospective study. Int J Clin Dent. 2022;15(4):669–676. ISSN: 1939-5833.
9. Sharan A, Madjar D. Correlation between maxillary sinus floor topography and related root position of posterior teeth using panoramic and cross-sectional computed tomography imaging. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006;102(3):375-81.
10. Abdulwahed A, Mustafa M, Karobari MI, Alomran A, Alasimi K, Alsayeg A, Alsakaker A, Alamri HM. Anatomical evaluation of posterior maxillary roots in relation to the maxillary sinus floor in a Saudi sub-population: a cross-sectional cone-beam computed tomography study. Healthcare (Basel). 2023;11(1):150.
11. Taner L, Gürsoy GM, Uzuner FD. Does gender have an effect on craniofacial measurements? Turk J Orthod. 2019 Jun;32(2):59-64.
12. Morgan N, Meeus J, Shujaat S, Cortellini S, Bornstein MM, Jacobs R. CBCT for diagnostics, treatment planning and monitoring of sinus floor elevation procedures. Diagnostics (Basel). 2023 May 10;13(10):1684.
13. Abdulwahed A, Mustafa M, Karobari MI, Alomran A, Alasimi K, Alsayeg A, Alsakaker A, Alamri HM. Anatomical evaluation of posterior maxillary roots in relation to the maxillary sinus floor in a Saudi sub-population: a cross-sectional cone-beam computed tomography study. Healthcare. 2023;11(1):150.
14. Kilic C, Kamburoglu K, Yuksel SP, Ozen T. An assessment of the relationship between the maxillary sinus floor and the maxillary posterior teeth root tips using dental cone-beam computerized tomography. Eur J Dent. 2010 Oct;4(4):462-7.
15. Sarilita E, Muhammad RM, Nugraha HG, et al. Anatomical relationship between maxillary posterior teeth and the maxillary sinus in an Indonesian population: a CT scan study. BMC Oral Health. 2024;24:1014. doi: 10.1186/s12903-024-04783-9.
16. Brook I. Sinusitis of odontogenic origin. Otolaryngol Head Neck Surg. 2006 Sep;135(3):349-55. doi: 10.1016/j.otohns.2005.10.059. PMID: 16949963.
17. von Arx T, Fodich I, Bornstein MM. Proximity of premolar roots to maxillary sinus: a radiographic survey using cone-beam computed tomography. J Endod. 2014 Oct;40(10):1541-8. doi: 10.1016/j.joen.2014.06.022. Epub 2014 Aug 13. PMID: 25129024.
18. Jung YH, Cho BH. Assessment of the relationship between the maxillary molars and adjacent structures using cone beam computed tomography. Imaging Sci Dent. 2012 Dec;42(4):219-24. doi: 10.5624/isd.2012.42.4.219. Epub 2012 Dec 23. PMID: 23301207; PMCID: PMC3534175.
19. Mohammed A, Reem A, Rawan A. Assessing the proximity of the roots of maxillary molars and premolars to the maxillary sinus in UAE residents. Open Dent J. 2022;16:e187421062211160. doi: 10.2174/18742106-v16-e221124-2022-59.
20. Jun BC, Song SW, Park CS, Lee DH, Cho KJ, Cho JH. The analysis of maxillary sinus aeration according to

aging process; volume assessment by 3-dimensional reconstruction by high-resolution CT scanning. Otolaryngol Head Neck Surg. 2005;132(3):429-34. doi: 10.1016/j.otohns.2004.11.012.
21. Li L, Fu Y, Huang S, Lai Z, Ge J. An analysis of the relationship between the maxillary molars and the maxillary sinus floor in adult patients using cone-beam computed tomography. Research Square. https://doi.org/10.21203/rs.2.13391/v2.
22. Rasool N, Shetty S, Buch S, Nair P, Kalaichelvan S, Jayasheelan N. Evaluation of the proximity of root apices of maxillary posterior teeth to the maxillary sinus floor using CBCT among different age groups: a retrospective study. J Pharm Bioallied Sci. 2024;16:S3809-S3811. doi: 10.4103/jpbs.jpbs_1280_24.
23. Etemadi S, Seylavi G, Yadegari A. Correlation of the maxillary sinus volume with gender and some craniofacial indices using cone beam computed tomography. Biosci Biotechnol Res Commun. 2017;10(3).
24. Bhatia N, Subramanian AK, Jeevanandan G, Alshathri FS, Alkhurayyif AI, El-Sherbiny M, Ibrahim AM, Aljarboa FA, Bahamdan M. Three-dimensional evaluation of maxillary sinus volume for adult patients with unilateral cleft lip and palate using cone-beam computed tomography. J Int Dent Med Res. 2024;16(1):1–6. Available from: http://www.jidmr.com
25. Lee WJ, Lee SJ, Kim HS. Analysis of location and prevalence of maxillary sinus septa. J Periodontal Implant Sci. 2010 Apr;40(2):56-60. doi: 10.5051/jpis.2010.40.2.56.
26. Iwanaga J, Wilson C, Lachkar S, Tomaszewski KA, Walocha JA, Tubbs RS. Clinical anatomy of the maxillary sinus: application to sinus floor augmentation. Anat Cell Biol. 2019 Mar;52(1):17-24.doi: 10.5115/acb.2019.52.1.17.
27. Arthanari A, Raj SS, Chander UJK, Palati S. Age estimation using third molar eruption stages and its maturation – A retrospective study among South Indian population. J Punjab Acad Forensic Med Toxicol.2022;22(1):106–111. doi:10.5958/0974-083X.2022.00019.X
28. Renugalakshmi A, Vinothkumar TS, Bokhari AM, Almahdi S, Almalki A, Balla SB, Tadakamadla SK, Hakami Z. Prevalence of dental anomalies and its role in sex estimation among children of Jazan Region, Saudi Arabia. Children (Basel). 2023;10(4):759. doi:10.3390/children10040759
29. Application in Pediatric Dental Care. Cureus. 2024;16(1):e52685.doi: 10.7759/cureus.52685
30. Dawoodbhoy FM, Delaney J, Cecula P, Yu J, Peacock I, Tan J, Cox B. AI in patient flow: applications of artificial intelligence to improve patient flow in NHS acute mental health inpatient units. Heliyon. 2021;7(5):e06993. doi: 10.1016/j.heliyon.2021.e06993.
31. Jussupow E, Spohrer K, Heinzl A. Identity Threats as a Reason for Resistance to Artificial Intelligence: Survey Study With Medical Students and Professionals. JMIR Form Res. 2022 Mar 23;6(3):e28750. doi: 10.2196/28750.